

## Innovations in food fermentation

Eddy J. Smid, Food Microbiology



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Fermentation, the solution to creating added value to (protein-rich) side streams. Online Symposium on 22-04-2021

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## Objective



Explore new ways to create value by fermentation of food raw materials

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## Rationale

- Fermented foods have been with us for centuries/millennia
- Knowledge of fermented foods has increased exponentially during the last ~30 years
- We can capitalise this knowledge to make radically new products

# Why?

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## How to innovate?

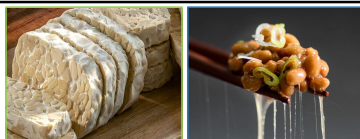


<https://paminter.co.za/blog/change-management-the-new-leadership-imperative/>

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- ✓ Tempeh (Indonesia)
- ✓ *Rhizopus* fermented
- ✓ Starter culture



- ✓ Natto (Japan)
- ✓ *Bacillus* fermented
- ✓ Starter culture

Various way to ferment soy beans



- ✓ Kinema (Nepal)
- ✓ *Bacillus* fermented
- ✓ Spontaneous



- ✓ Sufu (China)
- ✓ *Actinomyces*
- ✓ Starter

Fermented with different microbes

All with strong taste and aroma

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Same substrate > different microbes > different products



"cross-over fermentation concept"



The cross-over fermentation concept and its application in a novel food product: The dairy miso case study

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## – cross-over fermentation concept –

### DEFINITION CoF:

"A fermentation process in which microorganisms are taken from a traditional fermentation process and introduced onto a new substrate"



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## Example – Dairy-miso – a novel product



Traditional miso  
> a very strong flavour



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Miso = a Japanese seasoning

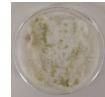
substrate : soybean paste  
ingredient: salt  
fermented with: koji

Koji\* = *Aspergillus oryzae* on rice

\*starter culture



*Aspergillus oryzae*



Koji

## Example – Dairy miso



Dairy miso

A taste/aroma bomb: "very old ripened cheese"



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Dairy miso = a novel Dutch/Danish seasoning

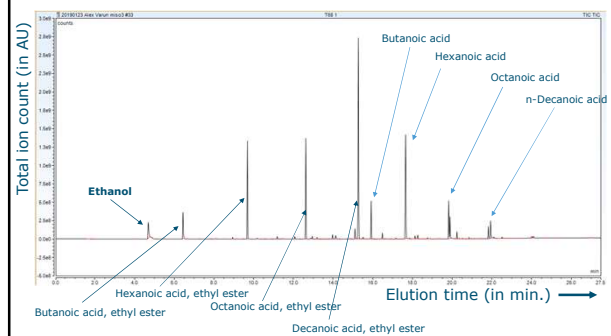
substrate : quark\*\*  
ingredient: salt  
fermented with: koji

Koji\* = *Aspergillus oryzae* on rice

\*starter culture

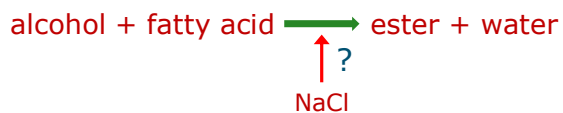
\*\* milk fermented with mesophilic lactic acid bacteria

## Volatile organic compounds in Dairy-miso



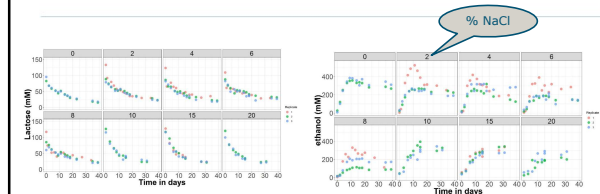
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## How to control aroma formation in Dairy-miso?



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## First: effect of salt on generation ethanol



No significant differences

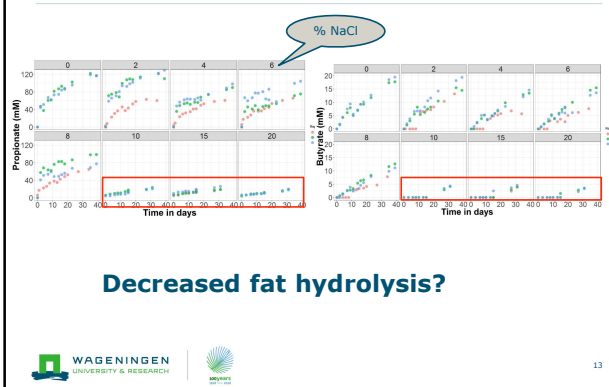
lactose consumption + ethanol production

~ 1.8% (v/v %) alcohol



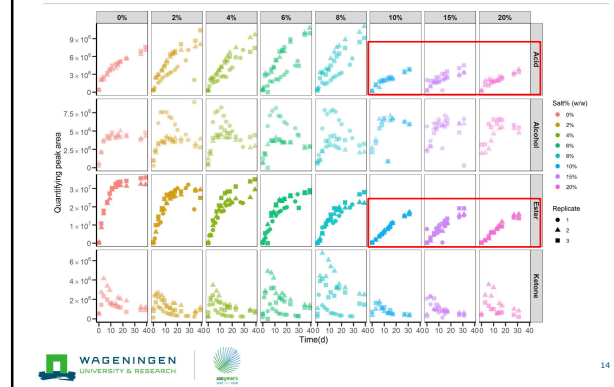
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### Effect of salt on fat degradation



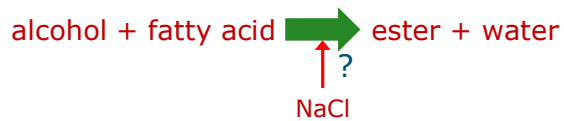
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### Effect of salt on aroma compound types



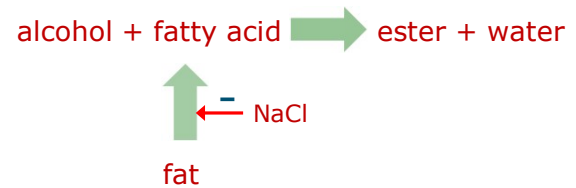
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### How to control aroma formation in Dairy-miso?



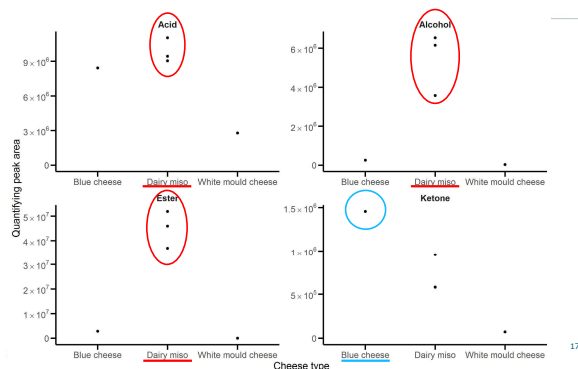
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### How to control aroma formation in Dairy-miso?



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### Comparison to other mould cheeses (6% dairy miso, 3 weeks old)



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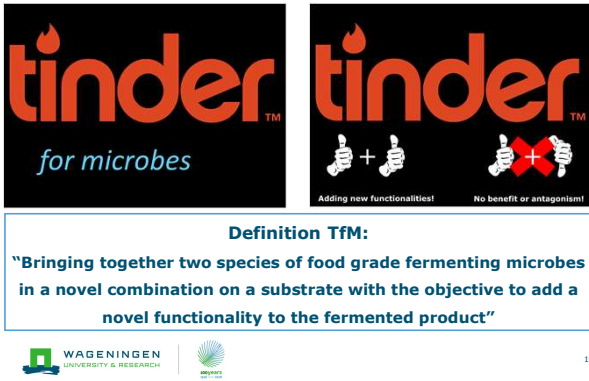
### Conclusions – Miso-quark

- *A. oryzae* can ferment quark
- Dairy miso is a true "aroma bomb"
- Traditionally used process variations can be applied in dairy miso for steering product characteristics
- Fat degradation rate is key for the formation of the most abundant aroma compounds
- *A. oryzae* shows potential for aroma block production using dairy products containing high amounts of fat



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Another innovation concept is:



**tinder™**  
for microbes

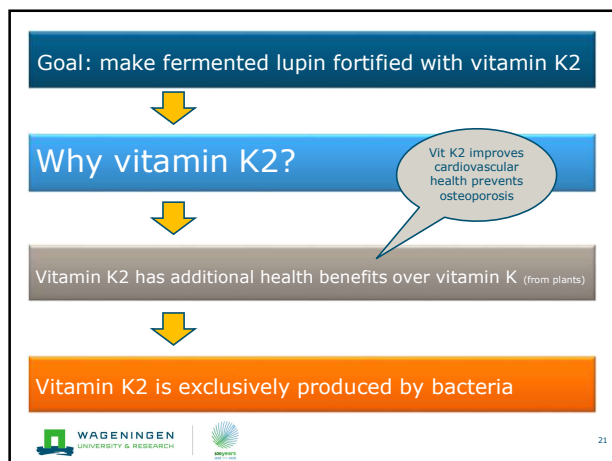
**Definition TFM:**  
"Bringing together two species of food grade fermenting microbes in a novel combination on a substrate with the objective to add a novel functionality to the fermented product"

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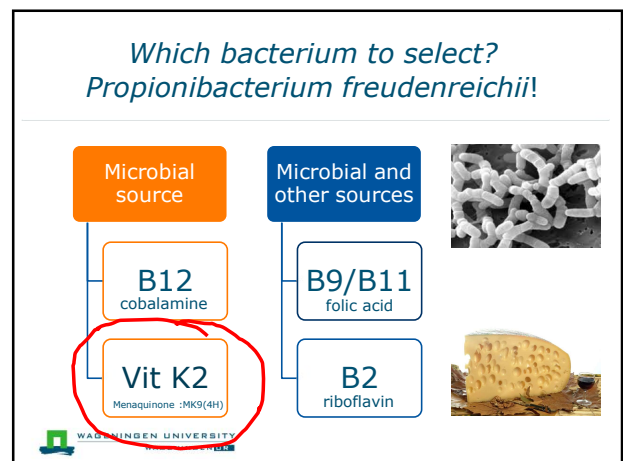
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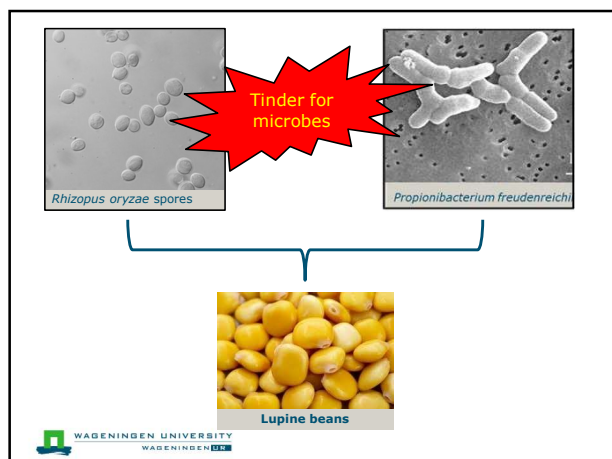
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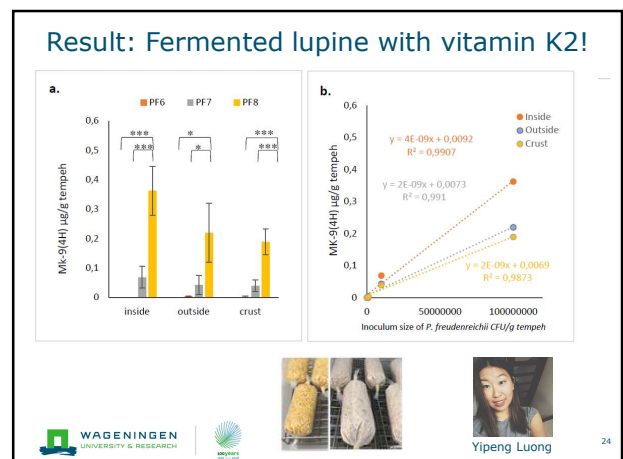
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## Take home messages/conclusions

- Knowledge of microbiology of food fermentation processes drives the design of new fermentation processes delivering new functionalities to food products
- Proof of principle for innovation concepts delivered
- CoF delivered dairy-miso: an aroma bomb!
- Lupine beans were enriched with vit K2 by applying Tfm

Thank you for  
your attention!



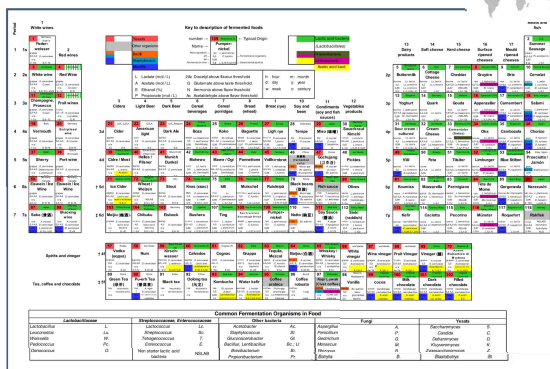
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1657–1658

From: M. G. Gänzle, 2015, Current Opinion in Food Science, 2:106–117

## Periodic table of fermented foods



■ Lactic acid bacteria ■ Yeast ■ Moulds